Si2493/57/34/15/04 Global ISOmodem-EVB

Evaluation Board Rev 5.0 for the Si2493/57/34/15/04 ISOmodem with UART and SPI Interfaces

Description

The global Si2493/57/34/15/04-EVB evaluation board Rev 5.0 provides the system designer an easy way of evaluating the Si2493/57/34/15/04 ISOmodem®. The Si2493/57/34/15/04-EVB consists of a motherboard with a power supply, an RS-232 and USB interface, other ease-of-use features, and a complete removable modem module on a daughter card. (A functional block diagram of the Si2493/57/34/15/04-EVB is shown below.) The Si2493/57/34/15/04 ISOmodem is a complete controller-based modem chipset with an integrated and programmable direct access arrangement (DAA) that meets global telephone line requirements. Available as a combination of one 16-pin small line-side device and one 24-pin or 16-pin system-side device, the Si2493/57/34/15/04 ISOmodem eliminates the need for a separate DSP data pump, modem controller, memories, codec, isolation transformer, relays, opto-isolators, and a 2- to 4-wire hybrid. The Si2493/57/34/15/04 is ideal for embedded modem applications due to its small board area, controller-based architecture, low power consumption, and global compliance. The Si2493/57/34/15/04-EVB provides an RJ-11 jack (for interfacing the Si2493/57/34/15/04-EVB to the phone line), and USB and RS232 serial ports for interfacing to a PC or data terminal. This allows the ISOmodem to operate as a serial modem for straightforward evaluation of the Si2493/57/34/15/04. To evaluate the Si2493/57/34/15/04 ISOmodem in an embedded system, the daughter card can be used independently of or with the motherboard.

A direct access header (J103) is available on the motherboard to bypass the RS-232 transceivers and connect the Si2493/57/34/15/04 ISOmodem directly to a target system.

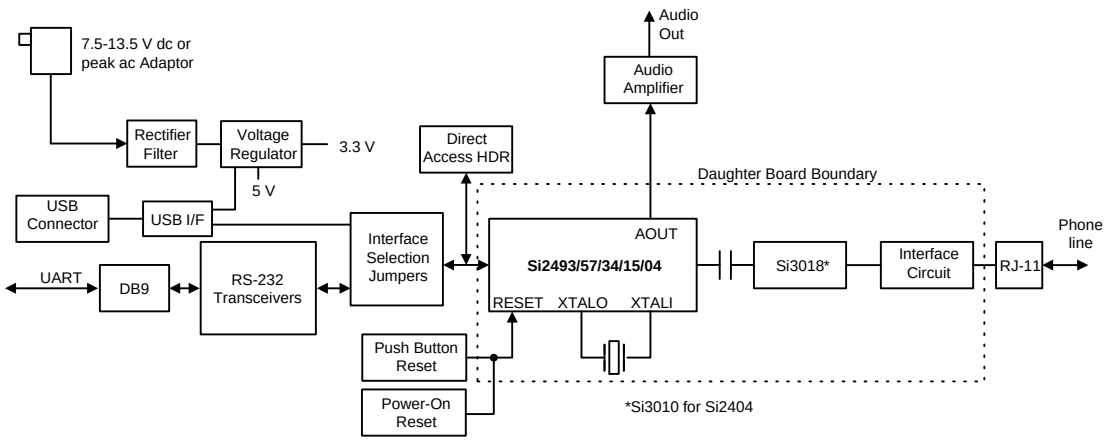
An on-board rectifier, filter, and voltage regulator allow the power input to be 7.5–13 V ac or dc (either polarity) supplied through a screw terminal (J8) or a standard 2 mm power jack (J9). Alternatively, power can be supplied through the USB interface (whether the USB or RS232 interface is used). The evaluation board can drive an external speaker for call monitoring or the speaker mounted directly on the board. Please note that the PCM interface, parallel interface, and EEPROM are available on the 24-pin FT only. See "1.7.EVB Part Numbers" on page 8 for ISOmodem EVB options.

Features

The Si2493/57/34/15/04-EVB includes the following:

- Dual RJ-11 connection to phone line
- RS-232 and USB interface to PC
- Speaker for call monitoring
- Direct access to Si2493/57/34/15/04 for embedded application evaluation
- Easy power connection to common 7.5 V–13.5 V power supplies or USB port.
- 9 V ac adaptor
- Simple installation and operation
- EEPROM (24-pin FT only)
- RS232 lines status display on LEDs.

Functional Block Diagram



Copyright © 2011 by Silicon Laboratories

1. Si2493/57/34/15/04-EVB Setup and Evaluation

This section explains how to set up the Si2493/57/34/15/04-EVB for evaluation as an RS-232 or USB interface modem. Jumper settings, power connection, PC/terminal connections, and terminal program configuration settings are given. The initial modem setup after power is applied as well as a basic tutorial on modem operation are provided. Si2493/57/34/15/04-EVB configurations for evaluating additional features are discussed separately. See the Si2493/57/34/15 or Si2404 data sheets and "AN93: Si2493/57/34/15/04/04 Modem Designer's Guide" for complete details.

1.1. Si2493/57/34/15/04-EVB Quick Start—RS-232 Interface

1. Set jumpers according to Figure 1, but change J6 to the arrangement shown in Figure 3 if an FS ISOmodem package is used.
2. Connect:
   - DB-9 to PC COM 1 (with a pass-through cable).
   - RJ-11 to phone line or CO simulator.
   - 9 V ac adaptor (or USB cable).
3. Bring up:
   - Turn on power to modem.
   - Autobaud automatically adjusts modem DTE speed and protocol.
4. Type "AT" followed by a carriage return.
   - Should echo "AT" and then an "OK".

1.2. Si2493/57/34/15/04-EVB Quick Start—USB Interface

1. Set jumpers according to Figure 3, but change J6 to the arrangement shown in Figure 3 if an FS ISOmodem package is used.
2. Connect:
   - USB cable to PC
   - RJ-11 to phone line or CO simulator
3. Download USB driver for your operating system from the CD supplied with the evaluation board.
4. Install driver.
5. Bring up.
   - Reset the modem.
   - Autobaud automatically adjusts modem DTE speed and protocol.
6. Type "AT" followed by a carriage return.
   - Should echo "AT" and then an "OK".

1.3. Motherboard and Daughter Card Configuration

The EVB consist of a motherboard that takes a plug in daughter card. The motherboard can be configured in a variety of ways that are explained below and are managed via jumpers. The daughter card contains both the modem system side and the isolated line interface (DAA).

The daughter card comes preconfigured and functional although the user may decide to change some operating options such as the type of crystal used with the modem chip or the type of control signals used, i.e. UART vs parallel. These features must be managed by changing strapping resistors soldered down to the daughter card and by changing parts associated with the crystal. These possible changes are explained below.

1.3.1. Motherboard Configuration

Check all the jumper setting on the S2493/57/34/15/04-EVB before applying power. The standard factory setting for the modem in a 24-pin FT package are shown in the figure below. This setup configures the modem for RS232 serial operation with autobaud enabled. Any standard terminal program configured to communicate through a PC com port can be used to communicate with the EVB.

Figure 1 shows the default motherboard setup for the FT package daughter card as well as the functions of connectors and jumpers.

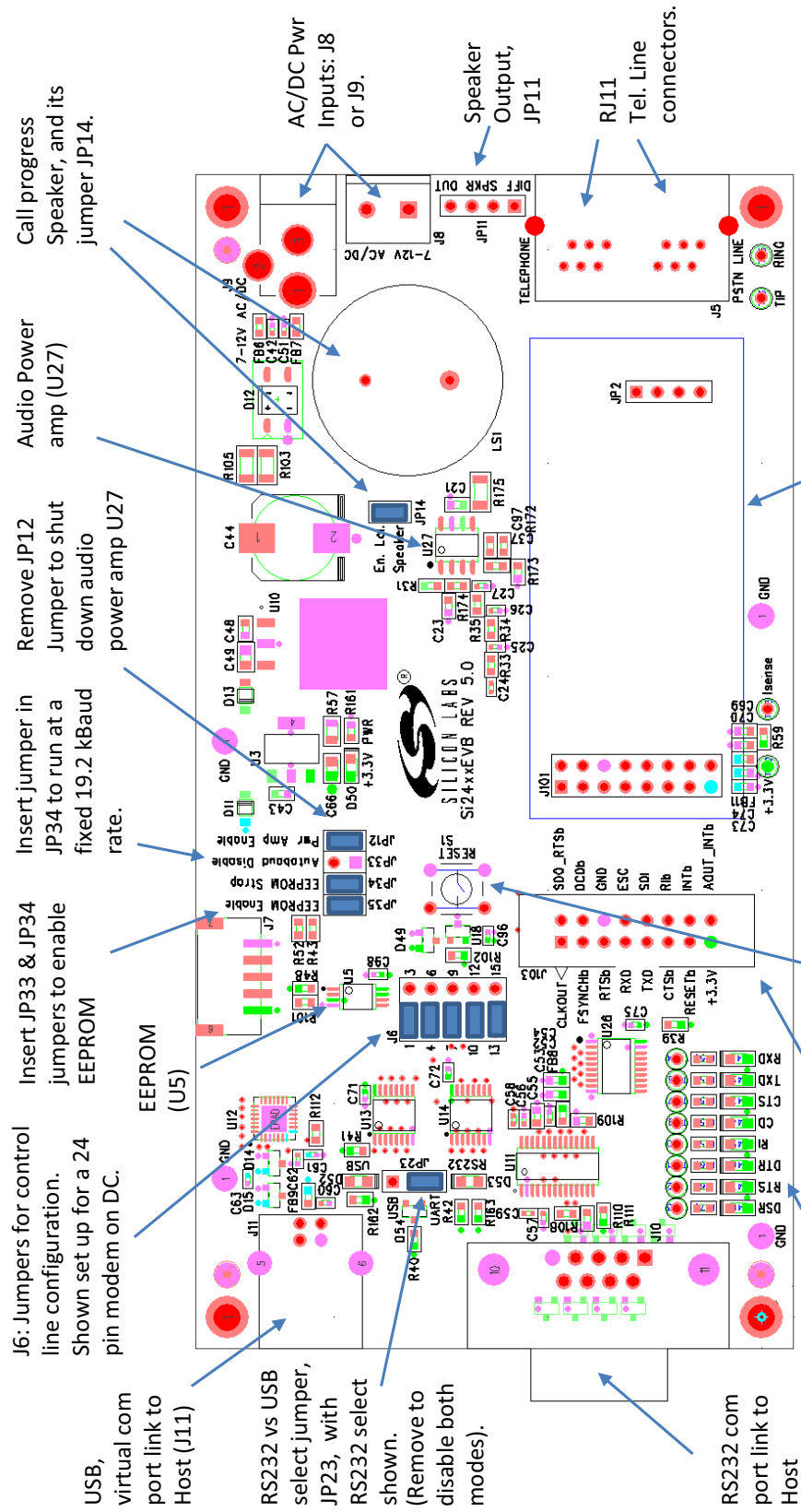

Call progress Speaker, and its jumper JP14.
AC/DC Pwr Inputs: J8 or J9.
Speaker Output, JP11
RJ11 Tel. Line connectors.
Tip and ring signals available at these test points.
Audio Power amp (U27)
Remove JP12 Jumper to shut down audio power amp U27
Modem daughter cards mate with J101 & JP2.
(Daughter card versions prior to rev. 2.0 will not fit this motherboard.)
Insert jumper in JP34 to run at a fixed 19.2 kBaud rate.
Tests points (+3.3V and Isense) that allow modem current o tbe measured via the 1.0 Ohm shunt: R59.
Insert JP33 & JP34 jumpers to enable EEPROM
EEPROM (U5)
Reset Pushbutton
J6: Jumpers for control line configuration. Shown set up for a 24 pin modem on DC.
System Connector. Allows all modem signals to be probed or routed elsewhere.
USB, virtual com port link to Host (J11)
RS232 vs USB select jumper, JP23, with RS232 select shown. (Remove to disable both modes).
RS232 com port link to Host
LEDs and test points showing status of all control lines as well as TX/RX

Figure 1. Default Motherboard Setup

1.3.1.1. RS232 vs USB vs User Provided IO Selection

To change to USB operation simply move the RS232 selection jumper on JP23 to the USB position as marked on the PCB and shown in Figure 1. When the USB vs UART settings are changed the appropriate indicator LED will light up on the EVB.

If neither jumper is in place then neither serial port will be activated and the user must provide I/O signals via the pins on J103. This IO can be in ASYNCH SERIAL, SPI SERIAL and Parallel Bus mode.

1.3.1.2. Autobaud Control

Autobaud is enabled with no jumper at the JP34 position. When a jumper is in place, autobaud is disabled and the user must setup the host to run 19k2 baud in order to use the modem.

1.3.1.3. EEPROM Control

To enable the EEPROM (U5) both jumpers JP34 and JP35 must be in place and the modem reset.

JP35 physically connects the EEPROM chips select line to the modem and allows the EEPROM to function when addressed by the modem, while JP34 connects a strapping option to the correct modem pin which is sensed during reset and instructs the modem firmware to use the EEPROM.

1.3.1.4. Call Progress Configuration

The modem call establishment can be heard by enabling the call progress feature via software (see AN93) and Hardware. The hardware components include installing JP12 which enabled the audio power amplifier and installing JP14 to connect the on board speaker to the power amplifier output. If an offboard speaker is to be used then JP14 can be removed and the alternate speaker can be connected to pins 1 and 4 of JP11. Note the this audio output is 8 Ω and differential so that neither output pin should be grounded.

1.3.1.5. Control Line Configuration

Various modem control lines can be rearranged depending on the user preferences and the specific modem chips used. This is done using JP6. The basic two JP6 configurations are shown in the following figures.

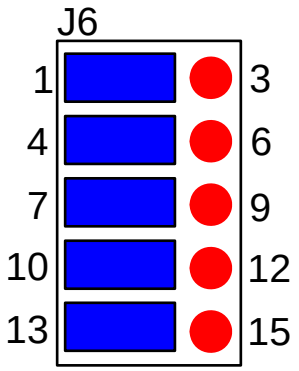


Figure 2. Default J6 Setup for 24-Pin Modem Chips

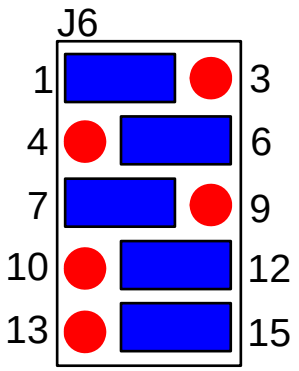


Figure 3. Default J6 Setup for 16-Pin Modem Chips

The specific details of what the jumpers connect are shown in Table 1, which is also found printed on the underside of the EVB.

Table 1. Routing of Control Signals with Jumper Position on J6

RS232 Signal	Si24xx 24-Pin		Si24xx 16-Pin		Si2401	
	Left	Right	Left	Right	Left	Right
DCD	DCD	SDI/EESD	DCD	NC	DCD	NC
RI	RI	FSYNCH	NC	RI	NC	RI
DTR	ESC	RI	ESC	NC	ESC	NC
RTS	RTS	SDO/ EECLK	NC	RTS	NC	GPIO1
DSR	INT	AOUT/INT	NC	INT	NC	AOUT/INT

1.3.2. Daughter Card Configuration

The daughter card comes configured with either a 24-pin FT or 16-pin FS system side part and either 32 kHz or 4.9152 MHz operation, and UART operation. The daughter card can also be setup to operate with a third clock frequency, an on board 27 MHz oscillator. To change between these options requires component changes on the daughter card.

The daughter card can also operate in three possible interface modes: parallel bus mode, in SPI mode as well as the default UART mode.

There are six small (0402) strapping resistors (R101 to R106) that are on the daughter card and are configured differently depending on the combination of chip package, clock frequency chosen, and interface mode. See Figures 5 and 6 for details.

The card and its options are shown in Figure 4, which shows the Modem Daughter card Rev 2.0 top and bottom views with the critical parts that may be changed to select another command mode (i.e. SPI) or an alternate crystal frequency, such as 4.9152 MHz.

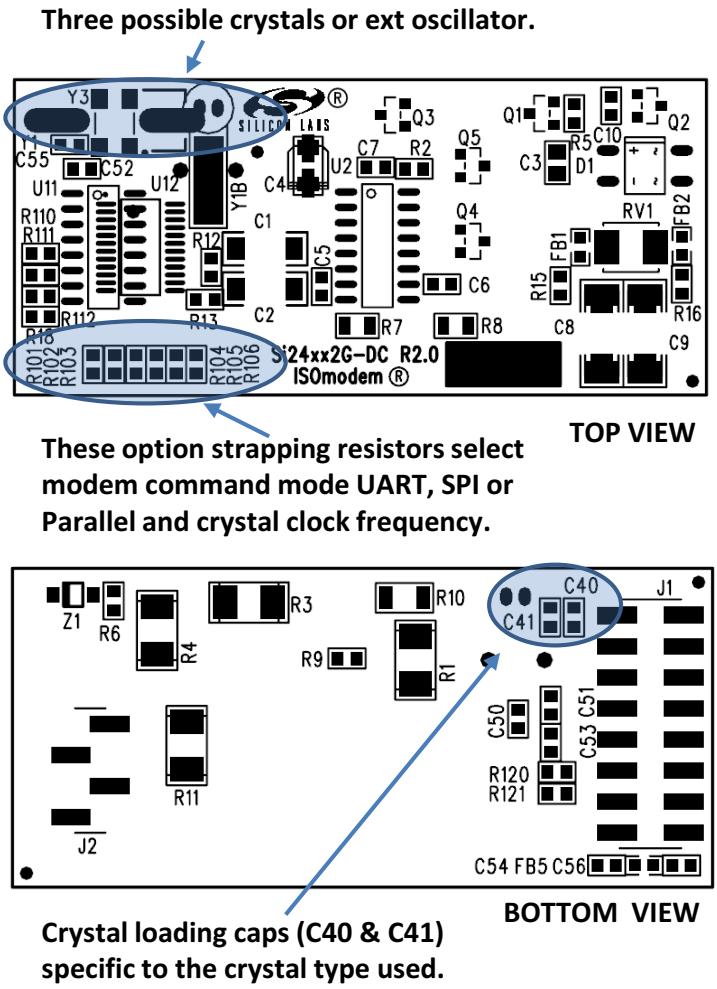


Figure 4. Modem Daughter Card Rev 2.0 Top and Bottom Views

Pin7 CTSb R101	Pin11 AOUT_INTb R102	Pin3 FSYNCH(RI) R103	Pin15 DCDb R106	
No	No	No	No	UART 4.9152 MHz
No	No	No	Yes	UART 27 MHz
No	Yes	No	No	SPI 32 kHz
No	Yes	No	Yes	SPI 27 MHz
No	No	Yes	X	UART 32 kHz
No	Yes	Yes	X	SPI 4.9252 MHz

Figure 5. R101–R106 Setup for Clock and Mode Configuration on the DC with the 16-Pin FS Package

Pin11 CTSb R101	Pin15 AOUT_INTb R102	Pin16 INTb R104	Pin17 RIb R105	Pin23 DCDb R106	
No	No	Yes	No	Yes	SPI 27 Mhz
No	No	Yes	Yes	X	SPI 4.9152 MHz
No	No	Yes	No	No	SPI 32.768 kHz
No	No	No	Yes	X	UART 32.768 kHz
No	No	No	No	No	UART 4.9152 MHz
No	No	No	No	Yes	UART 27 Mhz
Yes	Yes	X	X	X	Parallel 27 Mhz
No	Yes	X	X	X	Parallel 4.9152 MHz

Figure 6. R106 Setup for Clock and Mode Configuration on DC with 24-Pin FT Package

1.3.2.1. 32 kHz Setup

For 32 kHz, populate Y1 with the 32 kHZ crystal shown in the BOM and use 18 pF capacitors for the C40/C41 values. Also remove Y3 and Y1b if present and strap R101 to R106 as shown in Figure 5.

The modem should then work as expected; no changes are needed on the motherboard

1.3.2.2. 4.9152 MHz

For 4.9152 MHz, populate Y1b with the 4.9152 MHz crystal shown in the BOM and use 33 pF capacitors for the C40 and C41 values. Also remove Y3 and Y1 if present and strap R101 to R106 as shown in Figures 5 or 6 above.The modem should then work as expected; no changes are needed on the motherboard

1.3.2.3. 27 MHz

For 27 MHz, populate Y3 with the small surface mount oscillator shown in the BOM and remove Y3 and Y1b if present. Also remove any capacitors at the C40 and C41 positions.

Strap R101 to R106 as shown in Figures 5 or 6 above.

The modem should then work as expected; no changes are needed on the motherboard

1.3.2.4. SPI Mode Setup

To change to SPI mode setup it is necessary to configure the R101 straps as shown in Figure 5 or Figure 6, according to the package and clock used. Then setup the daughter card with neither UART nor USB operation selected, i.e. with no jumper on JP23. The SPI signals can then be obtained on J103, the system connector and connected to the host. Signal usage is described in Table 2.

Table 2. Signal Usage

SPI Function	JP23 Pin Number	Legacy Pin Function
SPI_CSb	5	RTSb
SPI_MISO	7	RXD
SPI_MOSI	9	TXD
SPI_SCLK	11	CTSb

1.3.3. Parallel Bus Mode Setup

To change to parallel bus mode setup it is necessary to configure the R101 straps as shown in Figure 5 or Figure 6, according to the package and clock used. Then setup the daughter card with neither UART nor USB operation selected, i.e. with no jumper on JP23. The SPI signals can then be obtained on J103, the system connector and connected to the host. See the data sheet and schematic for signal and pin usage.

1.4. Power Requirements

The Si2493/57/34/15/04-EVB has an on-board diode bridge, filter capacitor, and voltage regulator (U10 and U18). Power can be supplied from any source capable of providing 7.5 V–13 V dc or 7.5 V–13 V peak ac and at least 100 mA. (Additional current may be required if a speaker is connected for monitoring call progress tones.) Power may be applied to the Si2493/57/34/15/04-EVB through the screw terminals (J8), the 2 mm power jack (J9), or the USB cable (even if the modem is configured for RS-232 operation). The onboard full-wave rectifier and filter ensure the correct polarity is applied to the Si2493/57/34/15/04-EVB. Daughter card current can be measured by connecting a DVM across R59, a 1 Ω resistor using the supplied test points on

either side.

1.5. Terminal and Line Connections

The Si2493/57/34/15/04 can be tested as a standard serial data modem by connecting the Si2493/57/34/15/04-EVB to a personal computer or other data terminal equipment (DTE), phone line, and power. Connect a PC serial port to the DB9 connector on the Si2493/57/34/15/04-EVB with a pass-through cable. The RS-232 transceivers on the EVB can communicate with the DTE at rates up to 1 Mbps. Any standard terminal program, such as HyperTerminal or ProComm, running on a PC communicates with the Si2493/57/34/15/04-EVB. The standard factory jumper configuration has autobaud enabled. Autobaud detects the DTE speed, data length, parity, and number of stop bits.

If JP33 is installed, autobaud is disabled. Configure the terminal emulation program to 19200 bps, eight data bits, no parity, one stop bit, and hardware (CTS) handshaking. Connect the RJ-11 jack on the Si2493/57/34/15/04-EVB to an analog phone line or telephone line simulator, such as a Teltone TLS 5.

1.6. Making Connections

With the terminal program properly configured and running, apply power to the Si2493/57/34/15/04-EVB. Type “AT<cr>”, and the modem should return “OK” indicating the modem is working in the command mode and communicating with the terminal. If the “OK” response is not received, try resetting the modem by pressing the manual reset switch (S1); then, again type “AT<cr>.” Next, type “ATI6<cr>.” The modem should respond with “2493”, “2457”, “2434”, “2415”, or “2404” indicating the terminal is communicating with an Si2493, Si2457, Si2434, Si2415, or Si2404.

Type “ATS0=2<cr>” to configure the modem to answer on the second ring.

To take the modem off-hook, type “ATH1<cr>.” The modem should go to the off-hook state, draw loop current, and respond with an “OK.” Next, type “ATH<cr>” or “ATH0<cr>”, and the modem should hang up (go on-hook) and stop drawing loop current.

To make a modem connection, type “ATDT(called modem phone number)<cr>.” Once the connection is established, a “CONNECT” message appears indicating the two modems are in the data mode and communicating. Typing on one terminal should appear on the other terminal. To return to the command mode without interrupting the connection between the two modems, type “+++.” Approximately two seconds later, “OK” appears. The modem is now in command mode and accepts “AT” commands.Type “ATH” (or “ATH0”) to terminate the data connection, or type “ATO” to return to the data mode. After the ATO command, the modem resumes the data connection and no longer accepts AT commands.

1.7. EVB Part Numbers

The ISOmodem evaluation boards are offered in multiple speeds and packaging options. The first four numbers indicate the system-side device. The next two letters indicate the system-side package (FS–Lead-free, 16-pin SOIC; FT–Lead-free, 24-pin TSSOP). The final two numbers indicate the line-side device. See Figure 7.

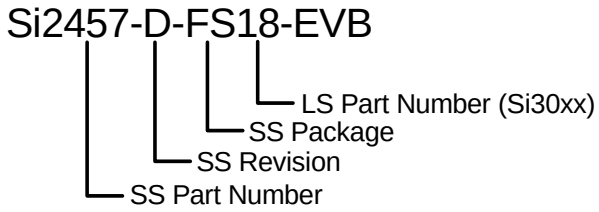


Figure 7. EVB Part Number Example

2. Si2493/57/34/15/04-EVB Functional Description

The Si2493/57/34/15/04-EVB is a multipurpose evaluation system. The modem daughter card illustrates the small size and few components required to implement an entire controller-based modem with global compatibility. The daughter card can be used independently of, or in conjunction with, the motherboard. The motherboard adds features that enhance the ease of evaluating the many capabilities of the Si2493/57/34/15/04 ISOmodem®.

2.1. Motherboard

The motherboard provides a convenient interface to the Si2493/57/34/15/04 DC (daughter card). The versatile power supply allows for a wide range of ac and dc voltages to power the board. RS-232 transceivers and a DB9 connector allow the Si2493/57/34/15/04-EVB to be easily connected to a PC or other terminal device. Jumper options allow direct access to the LVCMOS/TTL level serial inputs to the Si2493/57/34/15/04, bypassing the RS-232 transceivers or USB interface. This is particularly useful for directly connecting the Si2493/57/34/15/04 to embedded systems.

The Si24xxURT-EVB motherboard connects to the daughter card through two connectors, JP101 and JP2. JP101 is an 8x2 header providing connection to all Si2493/57/34/15/04 digital signals and regulated 3.3 V power for the Si2493/57/34/15/04. The Si2493/57/34/15/04 digital signals appearing at JP101 (daughter card interface) are LVCMOS and TTL compatible. JP2 is a 4x1 socket providing connection between the daughter

card and the RJ-11 phone jack.

2.1.1. Voltage Regulator/Power Supply

The input voltage to either J8 or J9 must be between 7.5 and 13.5 V dc or 7.5 and 13.5 V_{PEAK} ac. The motherboard includes a diode bridge (D12) to guard against a polarity reversal of the dc voltage or to rectify an ac voltage. The power source must be capable of continuously supplying at least 100 mA. C44 serves as a filter cap for an ac input. The voltage regulator, U10, provides 5 V for the motherboard and the input for voltage regulator U3, which outputs 3.3 V for use on the motherboard and to power the daughter card. Si24xxDC power consumption can be measured by placing a meter across R59. Power is supplied to U2 through D5 from the USB.

2.1.2. Reset Circuitry

The Si2493/57/34/15/04 requires a reset pulse to remain low for at least 5.0 ms after the power supply has stabilized during the powerup sequence or for at least 5.0 ms during a power-on reset. Most production Si2493/57/34/15/04 modem chipset applications require that $\overline{\text{RESET}}$ be controlled by the host processor. Certain Si2493/57/34/15/04 operation modes, including powerdown, require a hardware reset to recover.

The Si2493/57/34/15/04-EVB contains two reset options, an automatic power-on reset device, U18 (DS1818) (default), and a manual reset switch (S1) to permit resetting the chip without removing power. A reset, regardless of the mechanism, causes all modem settings to revert to factory default values.

2.1.3. Automatic Reset (DS1818)

The DS1818 is a small, low-cost device that monitors the voltage on V_D and an external reset pushbutton. If V_D drops below 3.0 V, the DS1818 provides a 220 ms active-low reset pulse. On powerup, the DS1818 also outputs an active low reset pulse for 220 ms after V_D reaches 90% of the nominal 3.3 V value. The DS1818 outputs a 220 ms reset pulse any time the power supply voltage exceeds the 3.3 V ±10% window.

2.1.4. Manual Reset

The manual reset switch (S1) performs a power-on reset. This resets the Si2493/57/34/15/04 to factory defaults without turning off power. Pressing S1 activates the reset monitor in the DS1818 and produces a 220 ms active low reset pulse.

2.1.5. EEPROM Enable (FT Only)

Connecting JP34 and JP35 enables the optional EEPROM, U5. See “AN93: Si2457/Si2434/Si2415/Si2404 Modem Designer’s Guide” for programming details.

2.1.6. Interface Selection

The serial interface of the Si2493/57/34/15/04-EVB can be connected to a computer, terminal, embedded system, or any other data terminal equipment (DTE) via a standard RS-232 interface, USB interface, or through a direct TTL serial interface.

The Si2493/57/34/15/04 can be tested as a standard data modem by connecting the Si2493/57/34/15/04-EVB to a personal computer or other DTE power supply and a phone line. A PC can communicate with the Si2493/57/34/15/04-EVB using a standard terminal program, such as HyperTerm or ProComm.

Jumper settings determine how the Si2493/57/34/15/04-EVB is connected to the DTE.

2.1.7. RS-232 Interface

This operation mode uses the standard factory jumper settings illustrated in Figure 1 on page 3. The Maxim MAX3237 transceiver interfaces directly with the TTL levels available at the serial interface of the Si2493/57/34/15/04 and, using internal charge pumps, makes these signals compatible with the RS-232 standard. The RS-232 transceiver on the Si2493/57/34/15/04-EVB can communicate at rates between 300 bps and 1 Mbps. This simplifies the connection to PCs and other data terminal equipment (DTE). The signals available on the Si2493/57/34/15/04-EVB serial interface (DB9 connector) are listed in Table 3.

2.1.8. USB Interface

The USB cable connects to J10 on the motherboard and provides both data and power. Installing a jumper on JP23 enables the USB interface and disables the RS-232 interface. The USB interface is provided by U12. A USB driver for this chip is available for most PC and MAC operating systems on the CD.

2.1.9. Direct Access Interface

While the motherboard supplies power through J8, J9, or USB, power-on reset, and an RJ–11 jack for the modem, the direct access interface (J103) is used to connect the motherboard to an embedded system. J103 provides access to all Si2493/57/34/15/04 signals available on the daughter card.

It is necessary to remove the jumper on JP23 to disable both the RS-232 and USB interface and prevent signal contention.

2.1.10. PCM Interface (24-Pin FT Only)

The Si2493/57/34/15/04 PCM interface can be demonstrated using the voice motherboard, not with this EVB.

2.1.11. AOUT Call Progress Audio Output

Call progress audio output is provided by the Si2493/57/34/15/04 on the AOUT pin as a PWM signal. This signal allows the user to monitor call progress signals, such as dial tone, DTMF dialing, ring, busy signals, and modem negotiation. Control of this signal is provided by AT commands and register settings described in the introduction. The AOUT signal is connected to an on board amplifier, for a high-quality output. AOUT can also be connected to a summing amplifier or multiplexer in an embedded application as part of an integrated audio system.

2.1.11.1. AOUT Audio Processing

The AOUT signal discussed in this section leaves the Si2493/57/34/15/04 is processed (demodulated) by a high pass filter: (R133,134,135, and C24, C25, 26, C27). It is critically important to not put a dc load on the AOUT pin since the pin also acts as a modem feature control on reset and is internally weakly pulled up. Any unintentional dc load on AOUT prevents proper operation of the modem. See “AN93: Si3457/34/15/04 Modem Designer’s Guide” for more details on the features controlled by pin strapping.

Since this PWM signal swings rail to rail and is simply filtered by a low pass filter to acquire the audio. It is important to keep the power supply to the modem free of noise in the audio spectrum.

2.1.11.2. The Audio Output Amplifier (LM4819)

The Power amplifier on the EVB is powered by a current limited 4.2 V supply. The current limit is implemented in the EVB because it is intended for HW/SW development and is not needed for a production design. This amplifier can drive an 8 Ω speaker with 200 mW of Call progress audio (i.e., ISOmodem's call progress dialing and negotiation tones).

The power amplifier itself is a low cost, rugged H bridge type device. There are several pin compatible designs from multiple vendors that can provide alternate price/power tradeoffs for this amplifier. This power amp can be shut down by removing jumper JP12. The signal at JP12 can also be tied to a control signal to allow the host to shut down the amplifier. The customer can change the values of R172 and R173 when integrating the EVB to his system, but should keep the RC formed by C37 and R173 at a 50 Hz or higher corner to avoid a power-on thump.

2.1.11.3. The Call Progress Speaker

The Call progress speaker, Regal RE-2308-NL is connected to the amplifier via a jumper, JP14. If another speaker is to be connected then it is necessary to remove JP14 and connect the external speaker to JP11, Pins 1 and 4. It is important to remember that the speaker signal is differential. Both the output pins are driven outputs and must not be grounded.

Table 3. DB9 Pin Connections

J1 Name	J1 Symbol	J1 Pin	Si2493/57/34/15/04 Pin	Si2493/57/34/15/04 Name
Carrier Detect	CD	1*	See note	$\overline{\text{DCD}}$/EESD
Received Data	RXD	2	9	RXD
Transmit Data	TXD	3	10	TXD
Data Terminal Ready	DTR	4*	See note	ESC/RI
Signal Ground	SG	5	6	GND
Data Set Ready	DSR	6*	See note	$\overline{\text{INT}}$/AOUT
Ready to Send	RTS	7*	See note	$\overline{\text{RTS}}$/RXCLK
Clear to Send	CTS	8	11	$\overline{\text{CTS}}$
Ring Indicator	RD	9*	17	$\overline{\text{RI}}$
***Note:** JP6 jumper option.				

2.2. Modem Daughter Card Operation

The Si2493/57/34/15/04URT-EVB daughter card is a complete modem solution perfectly suited for use in an embedded system. The daughtercard contains both the modem system-side chip and the isolated line interface (DAA).

The daughter card requires a 3.3 V supply capable of providing at least 35 mA and communicates with the system via LVCMOS/TTL-compatible digital signals on JP1. The RJ-11 jack (TIP and RING) is connected via JP2. Be sure to provide the proper power-on reset pulse to the daughter card if it is used in the stand-alone mode.

2.2.1. Reset Requirements

The Si2493/57/34/15/04 ISOmodem® daughter card must be properly reset at powerup. The reset pin (pin 8) of the Si2493/57/34/15/04 (JP103, J101 pin 13) must be held low for at least 5.0 ms after power is applied and stabilized to ensure the device is properly reset.

2.2.2. Crystal Requirements

Clock accuracy and stability are important in modem applications. To ensure reliable communication between modems, the clock must remain within ±100 ppm of the design value over the life of the modem. The crystal selected for use in a modem application must have a frequency tolerance of less than ±100 ppm for the combination of initial frequency tolerance, drift over the normal operating temperature range, and five year aging. Other considerations, such as production variations in PC board capacitance and the tolerance of loading capacitors, must also be taken into account.

2.2.3. Protection

The Si2493/57/34/15/04-EVB meets or exceeds all FCC and international PTT requirements and recommendations for high-voltage surge and isolation testing without any modification. The protection/isolation circuitry includes C1, C2, C8, C9, FB1, FB2, and RV1. The PCB layout is also a key “component” in the protection circuitry. The Si2493/57/34/15/04-EVB provides isolation to 3 kV. Contact Silicon Laboratories for information about designing to higher levels of isolation.

3. Design

The following sections contain the schematics, bill of materials, and layout for the Si2493/57/34/15/04 including the daughter card and motherboard.

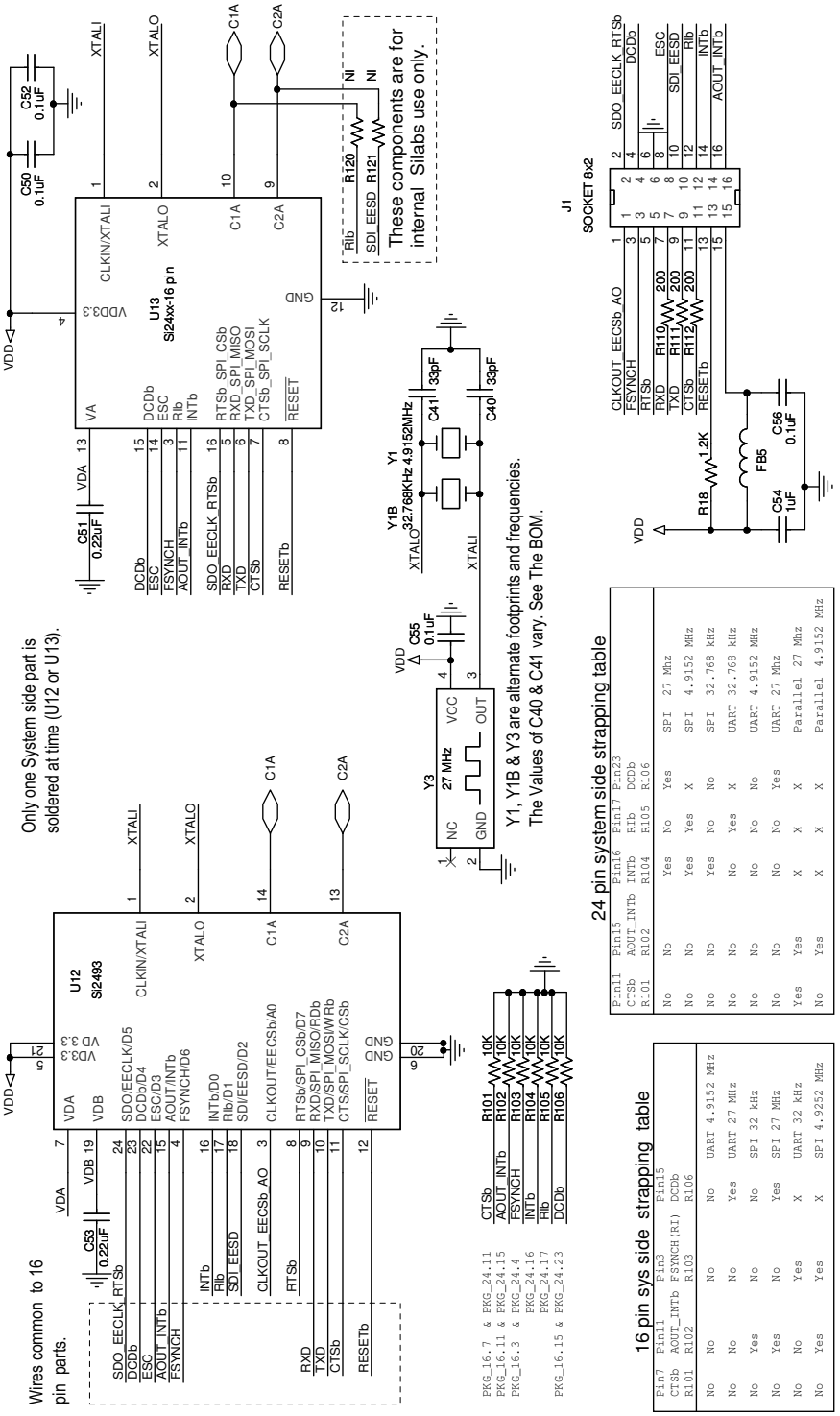

Only one System side part is soldered at time (U12 or U13).
Wires common to 16 pin parts.
U12
Si2493
U13
Si24xx-16 pin
These components are for internal Silabs use only.
Y1, Y1B & Y3 are alternate footprints and frequencies. The Values of C40 & C41 vary. See The BOM.
J1
SOCKET 8x2
24 pin system side strapping table
16 pin sys side strapping table

Figure 8. i2493/57/34/15/04 Schematic

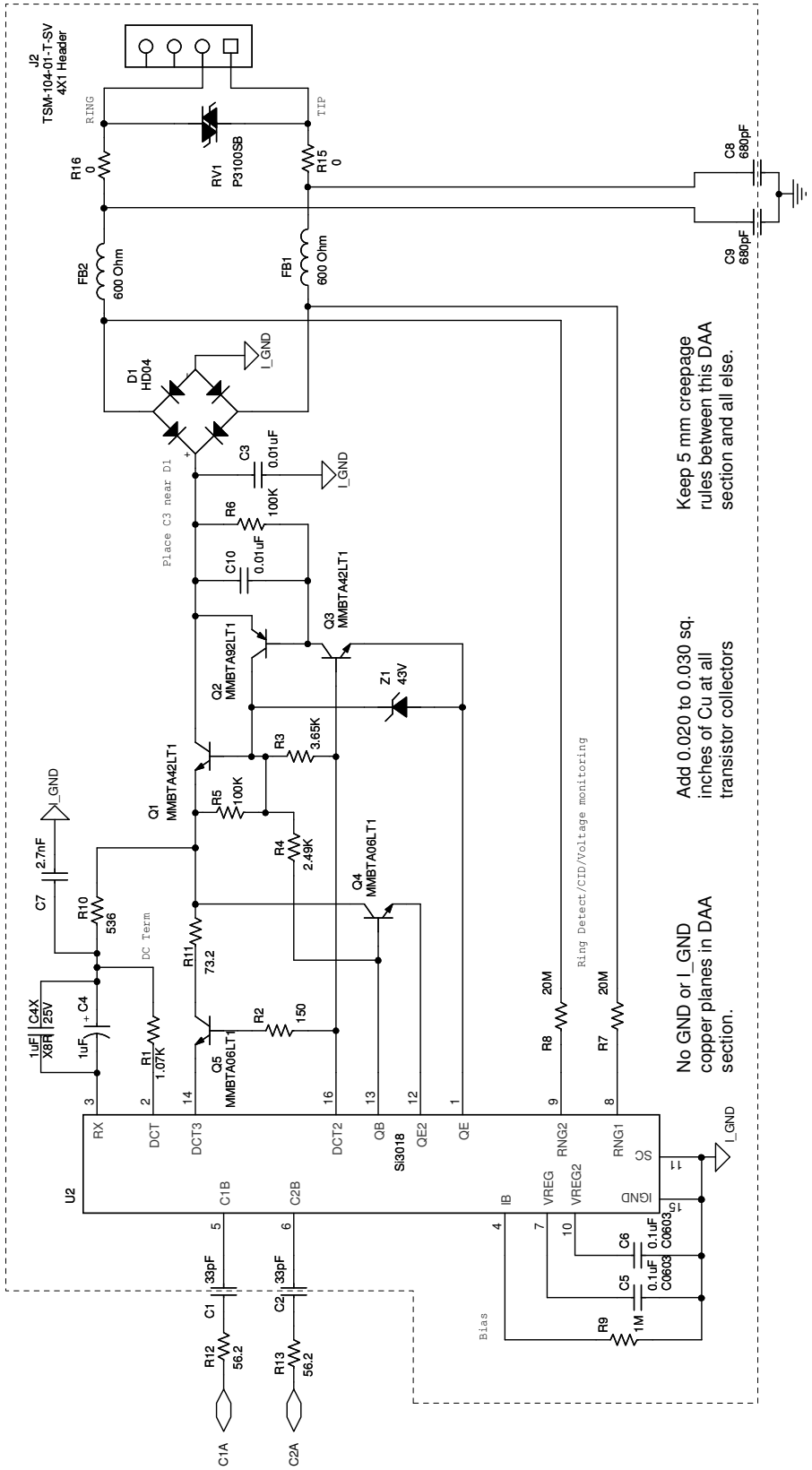


Figure 9. Si3018/10 DAA Schematic

4. Bill of Materials: Si24xx Daughter Card

Table 4. Si24xx Daughter Card Bill of Materials

Item	Qty	Ref	Value	Rating	Voltage	Tol	Type	PCB Footprint	Mfr Part Number	Mfr
1	2	C1, C2	33 pF	Y2	250 V	±10%	Y2	C1808	SCC1808X330K502T	Holy Stone
2	1	C3	0.01 µF		250 V	±10%	X7R	C0805	GRM21BR72E103KW03L	Murata
3	1	C4	1 µF		50 V	±20%	Alum_Elec	C3.3X3.3MM	EEE1HS010SR	Panasonic
4	2	C5, C6	0.1 µF		16 V	±20%	X7R	C0603	C0603X7R160-104M	Venkel
5	1	C7	2.7 nF		50 V	±20%	X7R	C0603	C0603X7R500-272M	Venkel
6	2	C8, C9	680 pF	Y2	250 V	±10%	Y2	C1808	SCC1808X681K502T	Holy Stone
7	1	C10	0.01 µF		16 V	±20%	X7R	C0603	C0603X7R160-103M	Venkel
8	2	C40, C41	18 pF		50 V	±5%	COG	C0603	C0603COG500-180J	Venkel
9	3	C50, C52, C56	0.1 µF		10 V	±20%	X7R	C0603	C0603X7R100-104M	Venkel
10	2	C51, C53	0.22 µF		6.3 V	±10%	X5R	C0603	C0603X7R6R3-224K	Venkel
11	1	C54	1 µF		25 V	±10%	X5R	C0603	C0603X5R250-105K	Venkel
12	1	D1	HD04	0.8 A	400 V		BRIDGE	MiniDIP4	HD04-T	Diodes Inc.
13	3	FB1, FB2, FB5	600 Ω	200 mA			SMT	L0603	BLM18AG601SN1	Murata
14	1	J1	SOCKET 8x2				SOCKET	SOCKETX8-100-SMT	SSW-108-22-G-D-VS	Samtec
15	1	J2	4X1 Header_0					CONN1X4-100-SMT	TSM-104-01-T-SV	Berg
16	2	Q1 Q3	MMBTA42LT1	200 mA	300 V		NPN	SOT23-BEC	MMBTA42LT1	On Semi
17	1	Q2	MMBTA92LT1	100 mA	300 V		PNP	SOT23-BEC	MMBTA92LT1	On Semi
18	2	Q4 Q5	MMBTA06LT1	500 mA	80 V		NPN	SOT23-BEC	MMBTA06LT1	On Semi
19	1	RV1	P3100SB		275 V		Sidactor	DO-214AA-NP	P3100SBL	Littelfuse
20	1	R1	1.07 kΩ	1/2 W		±1%	ThickFilm	R2010	CR2010-2W-1071F	Venkel
21	1	R2	150 Ω	1/16 W		±5%	ThickFilm	R0603	CR0603-16W-151J	Venkel
22	1	R3	3.65 kΩ	1/2 W		±1%	ThickFilm	R2010	CR2010-2W-3651F	Venkel
23	1	R4	2.49 kΩ	1/2 W		±1%	ThickFilm	R2010	CR2010-2W-2491F	Venkel
24	2	R5, R6	100 kΩ	1/16 W		±5%	ThickFilm	R0603	CR0603-16W-104J	Venkel
25	2	R7, R8	20 MΩ	1/8 W		±5%	ThickFilm	R0805	CR0805-8W-206J	Venkel
26	1	R9	1 MΩ	1/16 W		±1%	ThickFilm	R0603	CR0603-16W-1004F	Venkel
27	1	R10	536 Ω	1/4 W		±1%	ThickFilm	R1206	CR1206-4W-5360F	Venkel
28	1	R11	73.2 Ω	1/2 W		±1%	ThickFilm	R2010	CR2010-2W-73R2F	Venkel
29	2	R12, R13	56.2 Ω	1/16 W		±1%	ThickFilm	R0603	CR0603-16W-56R2F	Venkel
30	2	R15, R16	0 Ω	1 A			ThickFilm	R0603	CR0603-16W-000	Venkel
31	2	R120, R121	0 Ω	1 A			ThickFilm	R0603	CR0603-16W-000	Venkel
32	1	R18	1.2 kΩ	1/10 W		±5%	ThickFilm	R0603	CR0603-10W-121J	Venkel
33	4	R101, R102, R103, R104, R106	10 kΩ	1/10 W		±5%	ThickFilm	R0603	CR0603-10W-103J	Venkel

Table 4. Si24xx Daughter Card Bill of Materials (Continued)

Item	Qty	Ref	Value	Rating	Voltage	Tol	Type	PCB Footprint	Mfr Part Number	Mfr
34	1	R105	1 kΩ	1/10 W		±5%	ThickFilm	R0603	CR0603-10W-102J	Venkel
35	3	R110, R111, R112	200 Ω	1/10 W		±5%	ThickFilm	R0603	CR0603-10W-2000J	Venkel
36	1	U2	Si3018		300 V		LineSide	SO16N6.0P1.27	Si3018-F-GS	SiLabs
37	1	U12	Si24xx				ISOMODEM	TSSOP24N6.4P0.65	Si2493-E-FT	SiLabs
38	1	U13	Si24xx-16 pin					16pin SOIC	2493	Silicon Laboratories
39	1	Y1B (Y1, Y3)	32.768 kHz					XTAL-3X8-LD	ECS–.327–12.5–8X	ECS International
40	1	Z1	43 V	500 mW	43 V		Zener	SOD-123	BZT52C43-7-F	Diodes Inc.

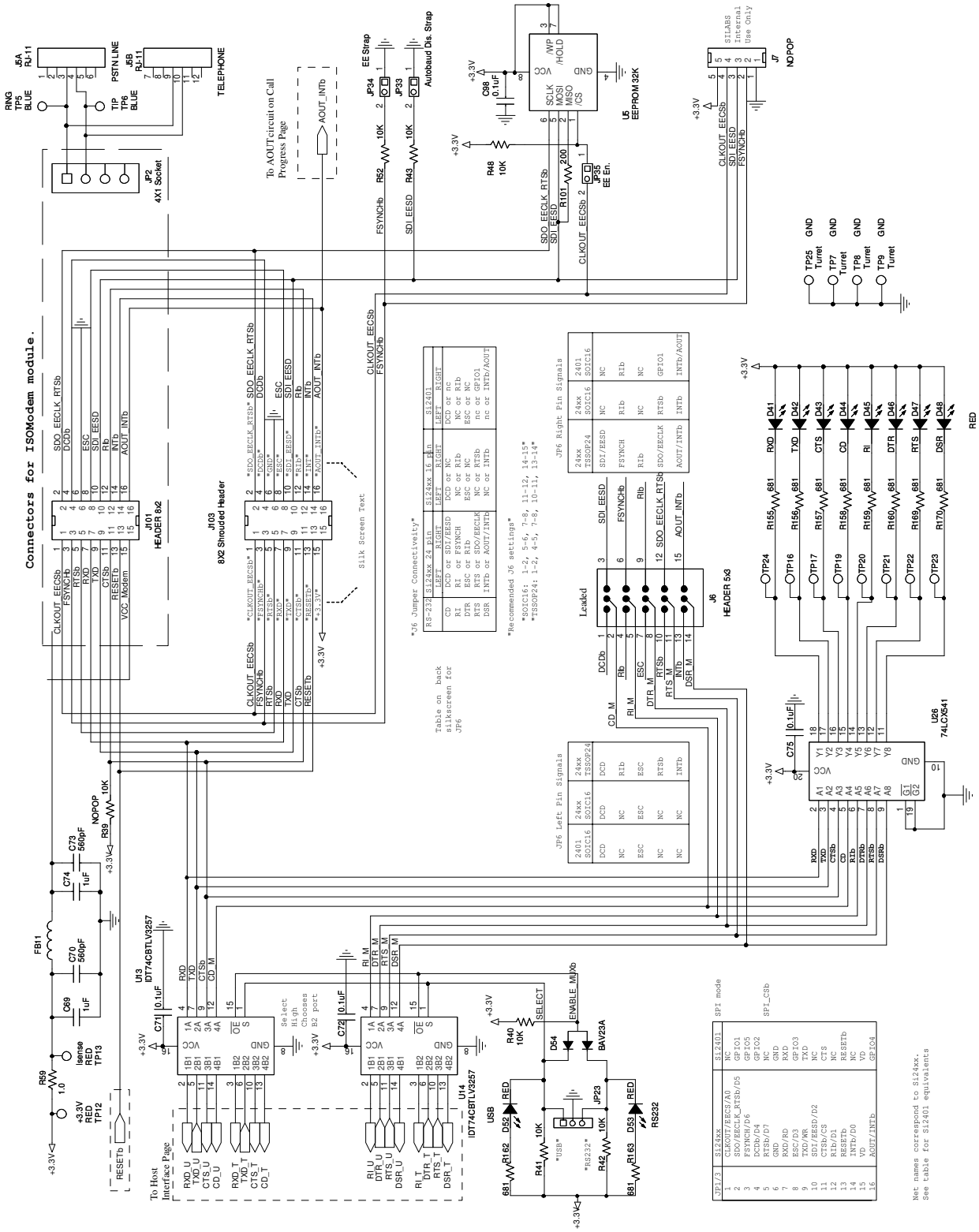


Figure 10. Motherboard Modem Interface Schematic

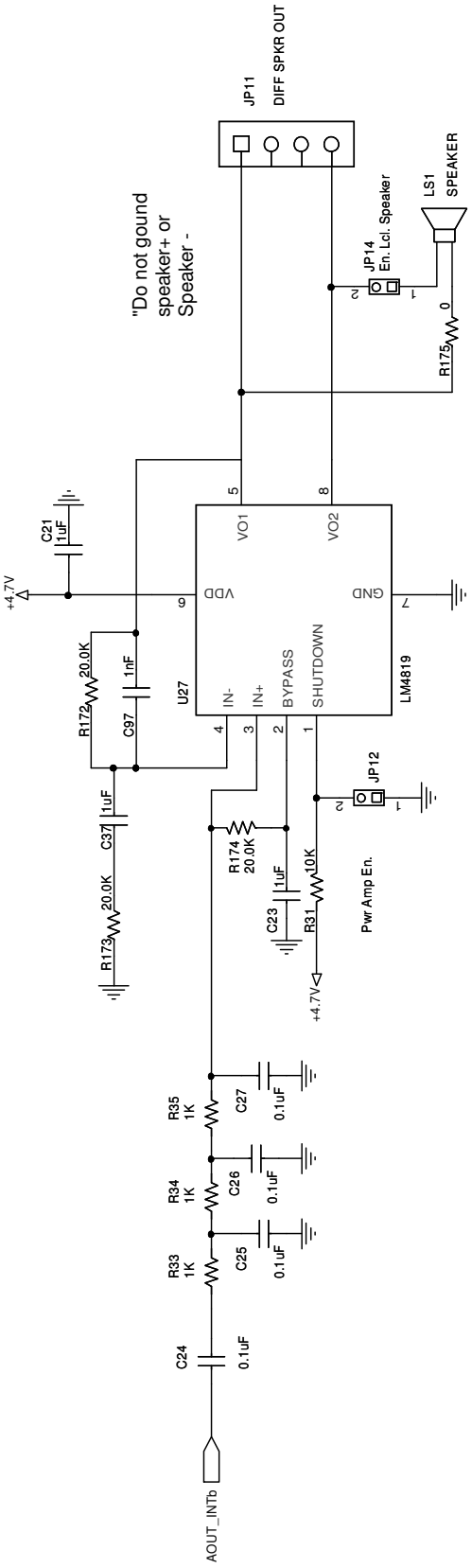


Figure 11. Audio Amplifier Schematic

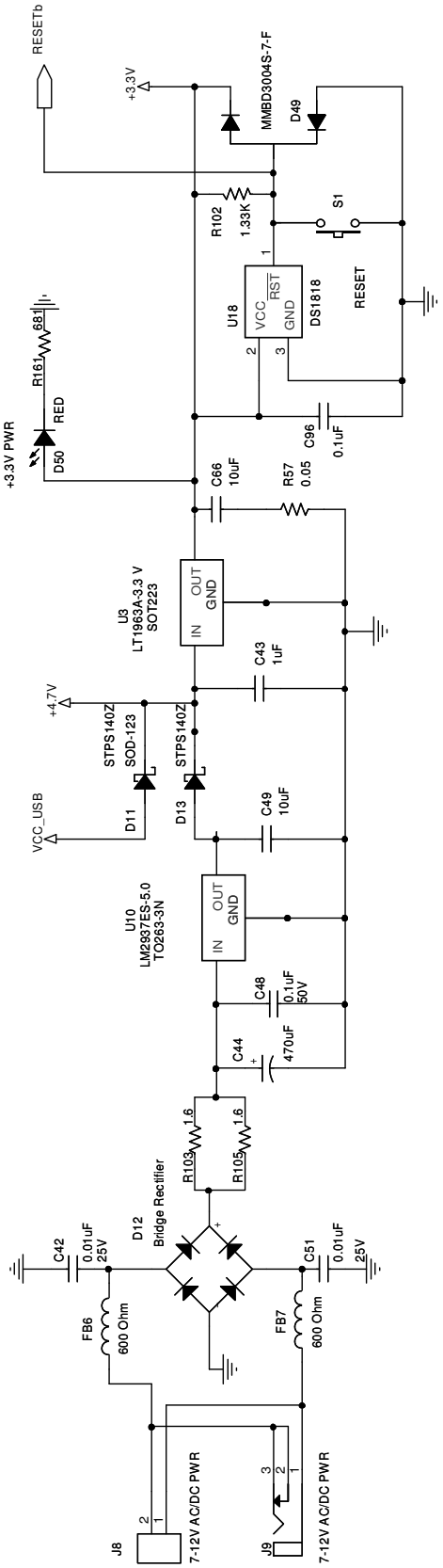


Figure 12. Power Supply Schematic

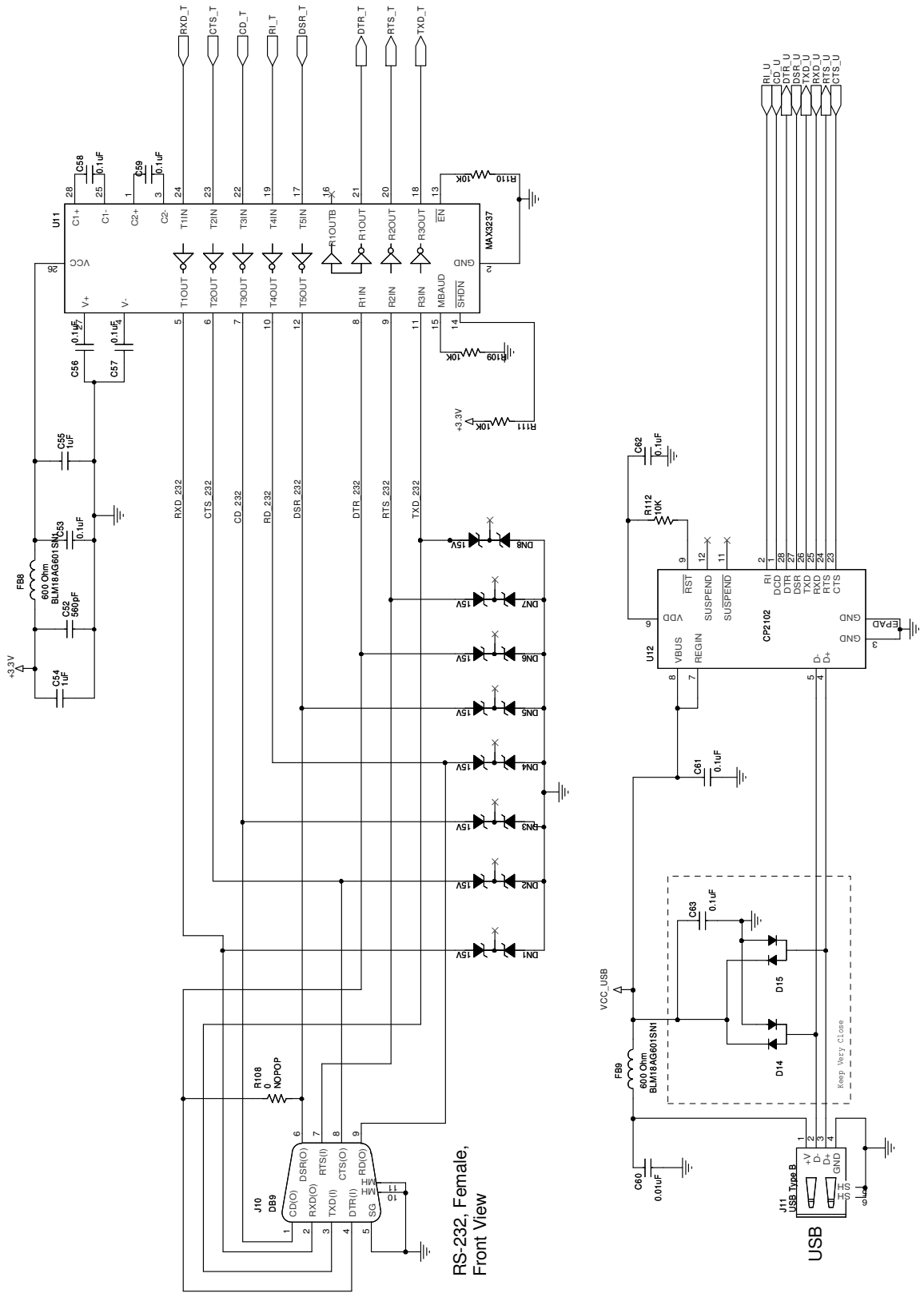


Figure 13. RS-232 Interface and USB Interface Schematic

5. Bill of Materials: Si24xx Motherboard

Table 5. Si24xx Motherboard Bill of Materials

Item	Qty	Ref	Value	Rating	Voltage	Tol	Type	PCB Footprint	Mfr Part Number	Mfr
1	8	C21, C23, C37, C43, C54, C55, C69, C74	1 µF		10 V	±10%	X7R	C0603	C0603X7R100-105K	Venkel
2	17	C24, C25, C26, C27, C53, C56, C57, C58, C59, C61, C62, C63, C71, C72, C75, C96, C98	0.1 µF		10 V	±20%	X7R	C0402	C0402X7R100-104M	Venkel
3	3	C42, C51, C60	0.01 µF		25 V	±10%	X7R	C0402	C0402X7R250-103K	Venkel
4	1	C44	470 µF		25 V	±20%	Alum_Elec	C10.3X10.3MM	EMVE250ADA471MJA0G	United Chemicon
5	1	C48	0.1 µF		50 V	±10%	X7R	C0603	C0603X7R500-104K	Venkel
6	2	C49, C66	10 µF		16 V	±10%	X5R	C0805	C0805X5R160-106K	Venkel
7	3	C52, C70, C73	560 pF		16 V	±10%	X7R	C0603	C0603X7R160-561K	Venkel
8	1	C97	1 nF		100 V	±10%	X7R	C0603	C0603X7R101-102K	Venkel
9	8	DN1, DN2, DN3, DN4, DN5, DN6, DN7, DN8	15 V	225 mW	15 V		Zener, Dual	SOT23-AAK	MMBZ15VDLT1G	On Semi
10	2	D11, D13	STPS140Z	1.0 A	40 V		Schottky	SOD-123	STPS140Z	ST MICRO
11	1	D12	Bridge Rectifier	0.8 A	100 V		BRIDGE	MiniDIP4	HD01-T	Diodes Inc.
12	3	D14, D15, D49	MMBD3004S-7-F	225 mA	300 V		DUAL	SOT23-AKC	MMBD3004S-7-F	Diodes Inc.
13	11	D41, D42, D43, D44, D45, D46, D47, D48, D50, D52, D53	RED	25 mA	1.9 V		SMT, Chip LED	LED-HSMX-C170	HSMC-C170	Avago Technologies
14	1	D54	BAV23A	400 mA	200 V		DUAL	SOT23-KKA	BAV23A	Diodes Inc.
15	5	FB6, FB7, FB8, FB9, FB11	600 Ohm	200 mA			SMT	L0603	BLM18AG601SN1	MuRata
16	4	HW1, HW2, HW3, HW4	spacer						2397	SPC Technology
17	4	HW5, HW6, HW7, HW8	screw						NSS-4-4-01	Richco Plastic Co

Table 5. Si24xx Motherboard Bill of Materials (Continued)

Item	Qty	Ref	Value	Rating	Voltage	Tol	Type	PCB Footprint	Mfr Part Number	Mfr
18	1	JP11	HEADER 4X1				Header	CONN-1X4	TSW-104-07-T-S	Samtec
19	2	JP12, JP14	JUMPER				Header	CONN-1X2	TSW-102-07-T-S	Samtec
20	1	JP23	HEADER 1x3				Header	CONN-1X3	TSW-103-07-T-S	Samtec
21	3	JP33, JP34, JP35	JUMPER				Unshrouded	CONN-1X2	68000-402	Berg
22	1	J5	RJ-11				RJ-11	RJ11-DUAL-MTJG	MTJG-2-64-2-2-1	ADAM TECH
23	1	J6	HEADER 5x3				Header		TSW-105-07-S-T	Samtec
24	1	J8	CONN TRBLK 2				TERM BLK	CONN-1X2-TB	1729018	PHOENIX CONTACT
25	1	J9	Power Jack	1 A			BARREL	CONN-3-PWR	ADC-002-1	Adam Tech
26	1	J10	DB9				D-SUB	CONN-9-DBF	D09S33E4GX00LF	FCI
27	1	J11	USB Type B				USB	CONN-USB-B	292304-1	Tyco
28	1	J101	HEADER 8x2				Header	CONN2X8	16/80 pins of 9-146252-0-08	Tyco/AMP
29	1	J102	Socket 1x4				Header		SSW-104-01-T-S	Samtec
30	1	J103	8X2 Shrouded Header				Shrouded	CONN2X8-4W	5103309-3	Tyco
31	1	LS1	SPEAKER	0.5 W Max				RE-2308-NL	RE-2308-NL	Regal
32	7	R31, R40, R41, R42, R43, R52, R109, R110, R111, R112	10 kΩ	1/10 W		±1%	ThickFilm	R0603	CR0603-10W-1002F	Venkel
33	3	R33, R34, R35	1 kΩ	1/16 W		±1%	ThickFilm	R0603	CR0603-16W-1001F	Venkel
34	1	R48	100 kΩ	1/10 W		±1%	ThickFilm	R0603	CR0603-10W-1003F	Venkel
35	1	R57	0.05 Ω	1/4 W		±5%	ThickFilm	R0805	LCR0805-R050J	Venkel
36	1	R59	1 Ω	1/10 W		±1%	ThickFilm	R0603	CR0603-10W-1R00F	Venkel
37	1	R101	200 Ω	1/10 W		±5%	ThickFilm	R0603	CR0603-10W-2000J	Venkel
38	1	R102	1.33 kΩ	1/10 W		±1%	ThickFilm	R0603	CR0603-10W-1331F	Venkel
39	2	R103, R105	1.6 Ω	1/4 W		±5%	ThickFilm	R1206	CR1206-8W-1R6J	Venkel
40	11	R155, R156, R157, R158, R159, R160, R161, R162, R163, R169, R170	681 Ω	1/10 W		±1%	ThickFilm	R0603	CR0603-10W-6810F	Venkel

Table 5. Si24xx Motherboard Bill of Materials (Continued)

Item	Qty	Ref	Value	Rating	Voltage	Tol	Type	PCB Footprint	Mfr Part Number	Mfr
41	3	R172, R173, R174	20.0 kΩ	1/16 W		±1%	ThickFilm	R0603	CR0603-16W-2002F	Venkel
42	1	R175	0	2 A			ThickFilm	R1206	CR1206-4W-000	Venkel
43	1	S1	SW PUSH-BUTTON	50 mA	12 Vdc		Tactile	SW4N6.5X4.5-PB	101-0161-EV	Mountain Switch
44	10	TP5, TP6, TP16, TP17, TP19, TP20, TP21, TP22, TP23, TP24	BLUE				Loop	TESTPOINT	151-205-RC	Kobiconn
45	4	TP7, TP8, TP9, TP25	Turret				Turret	TP[12594]	2551-2-00-44-00-00-07-0	Mill-Max
46	1	TP11	RED				Loop	TESTPOINT	151-207-RC	Kobiconn
47	1	U3	LT1963A-3.3 V	1.5 A max			LDO	SOT223	LT1963AEST-3.3#PBF	Linear Technologies
48	1	U5	EEPROM 32K				Serial	TSSOP8N6.4P0.65	25LC320A-I/ST	Microchip Technology
49	1	U10	5	0.5 A max			LDO	TO263-3N	LM2937ES-5.0	National Semiconductors
50	1	U11	MAX3237		5.5 V		RS232	TSSOP	MAX3237EIPWR	TI
51	1	U12	CP2102				MCU	QFN28N5X5P0.5	CP2102-GM	SiLabs
52	2	U13, U14	IDT74CBTLV3257					TSSOP-16	IDT74CBTLV3257	IDT
53	1	U18	DS1818		3.3 V	10%		SOT-23	DS1818-10	Dallas Semiconductor
54	1	U26	74LCX541				Buffer	TSSOP20N6.4P0.65	74LCX541MTC	Fairchild
55	1	U27	LM4819	350 mW				SO8N6.0P1.27	LM4819M	National Semiconductor
Unpopulated Components										
56	1	J7	2MM, RT ANG				SHROUDED	CONN1X5-S5B-PH-SM4-TB	S5B-PH-SM4-TB	JST
1	1	R39	10 kΩ	1/10 W		±1%	ThickFilm	R0603	CR0603-10W-1002F	Venkel
1	1	R108	0	1 A			ThickFilm	R0603	CR0603-16W-000	Venkel

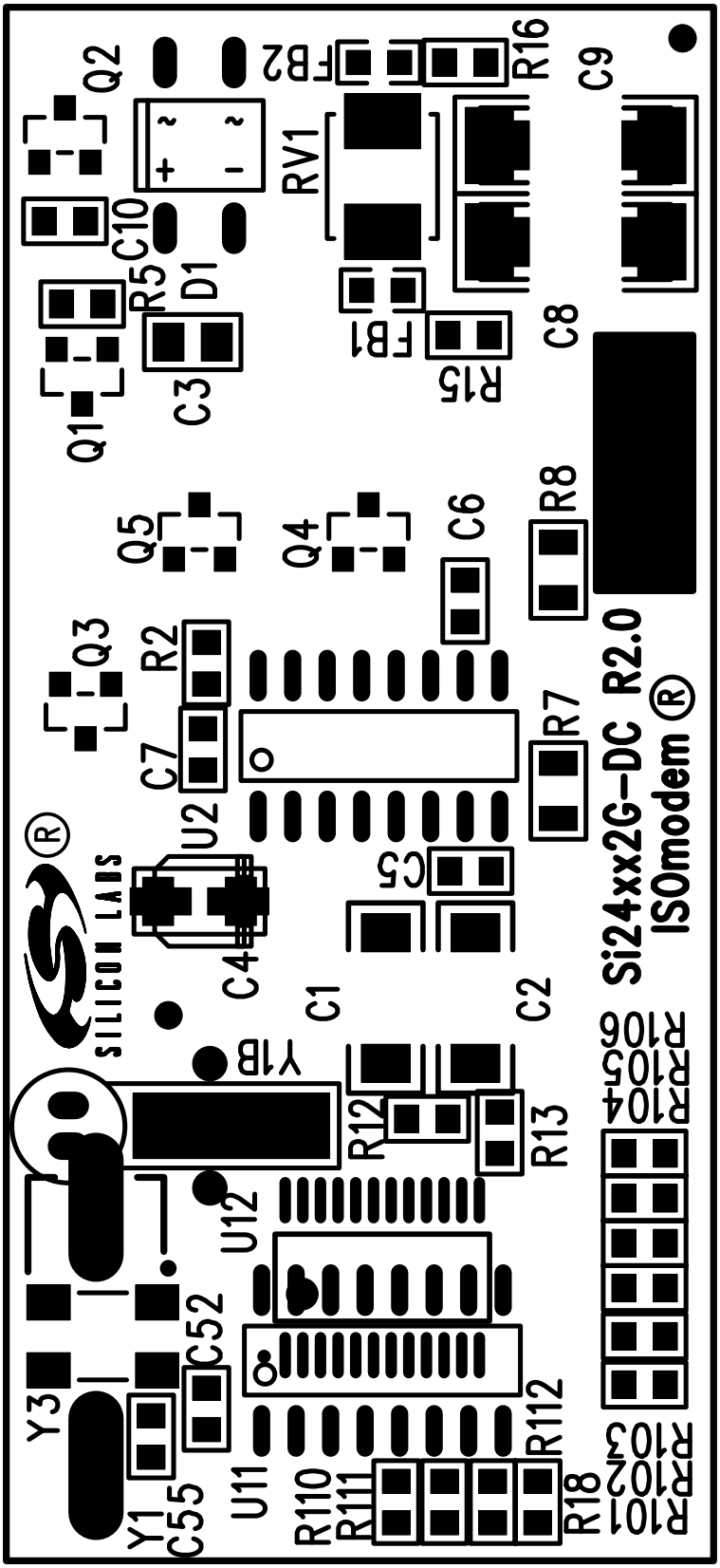


Figure 14. Daughter Card Primary Side Silkscreen

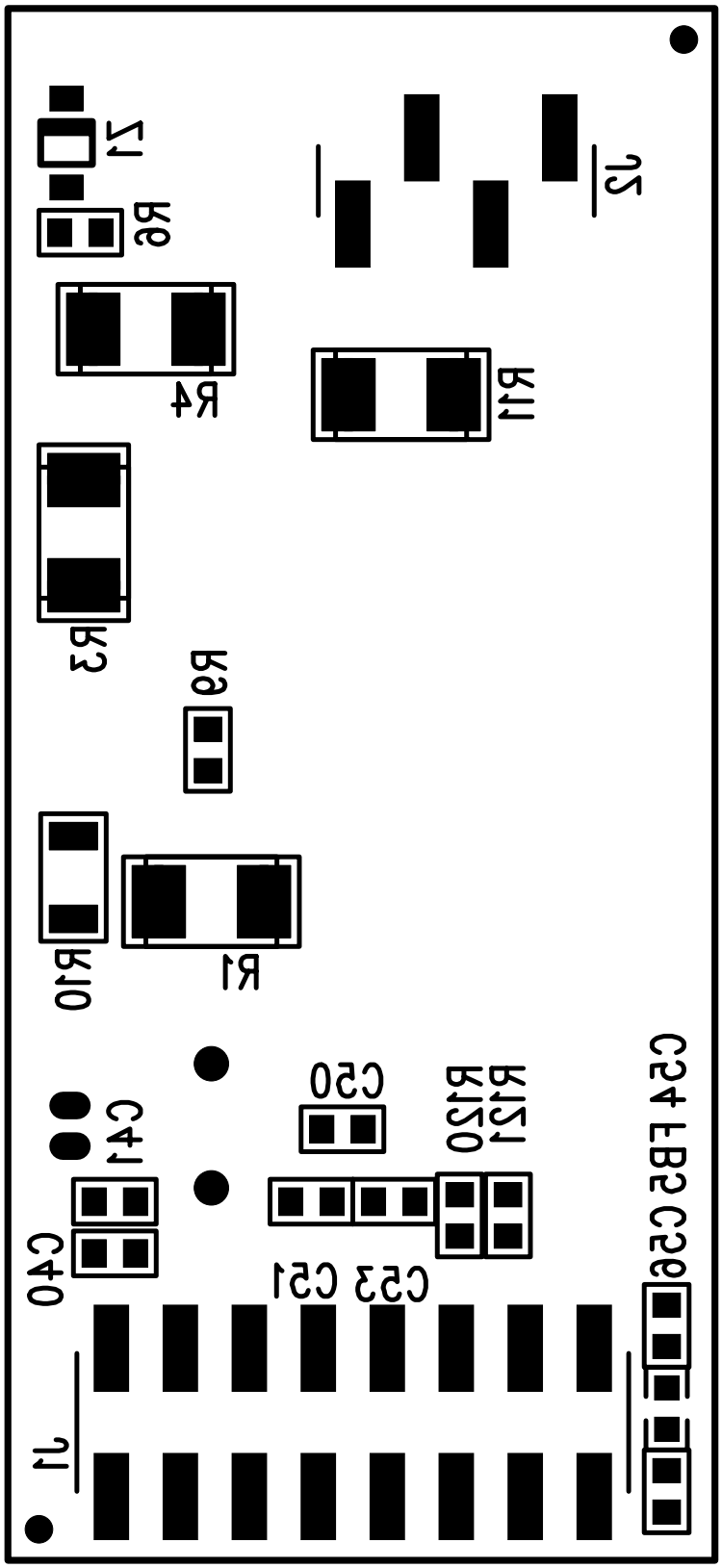


Figure 15. Daughter Card Secondary Side Silkscreen

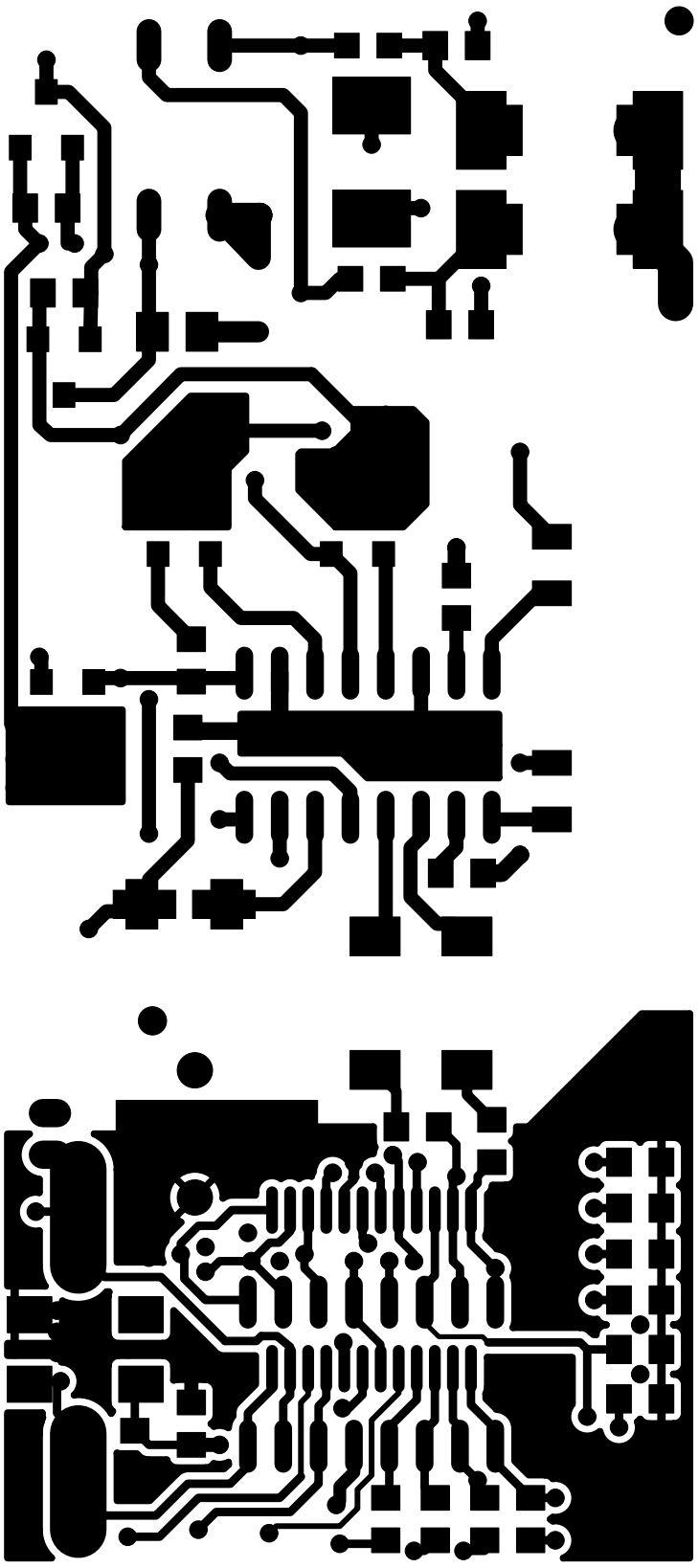


Figure 16. Daughter Card Primary Side Layout

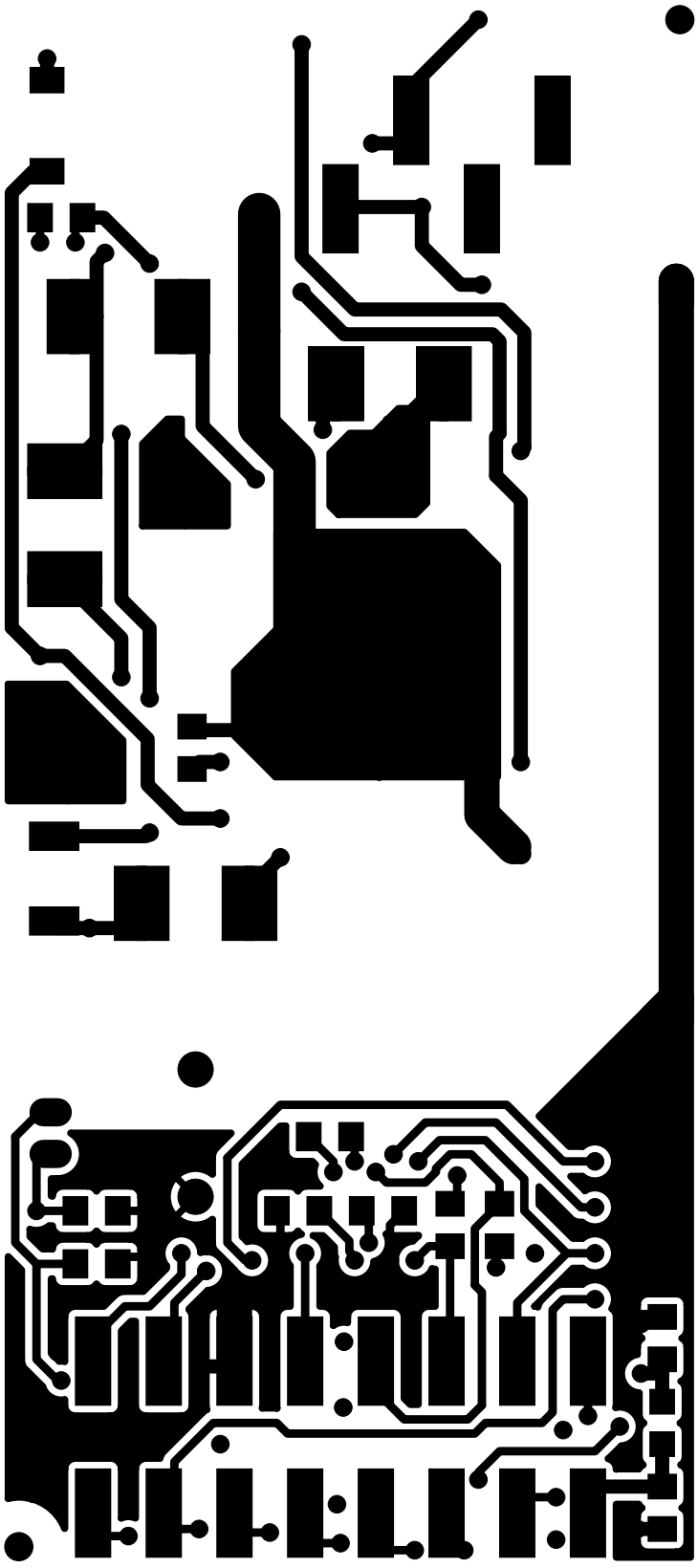


Figure 17. Daughter Card Secondary Side Layout

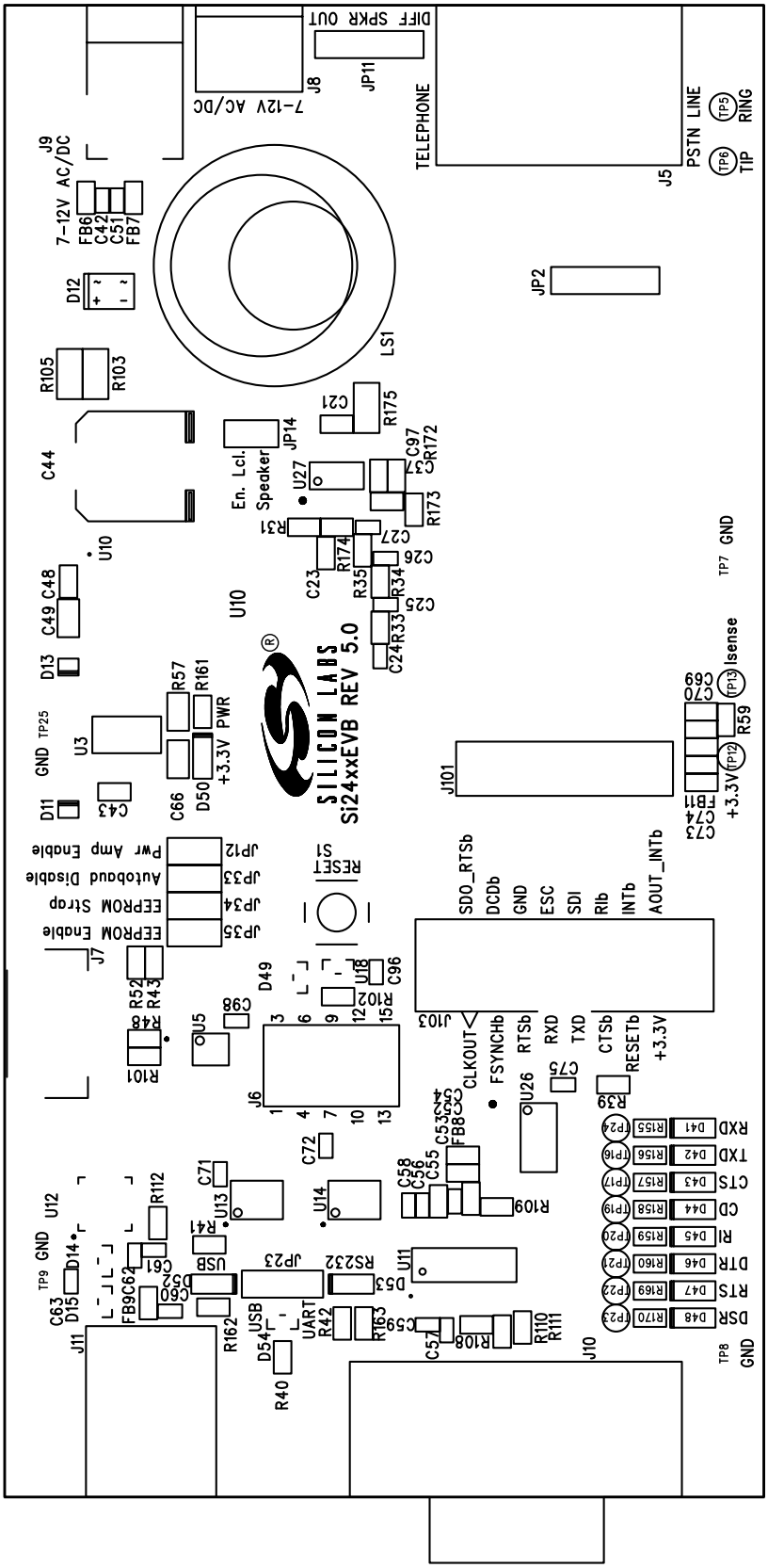


Figure 18. Motherboard Primary Side Silkscreen

Figure 19. Motherboard Silkscreen (Secondary Side)

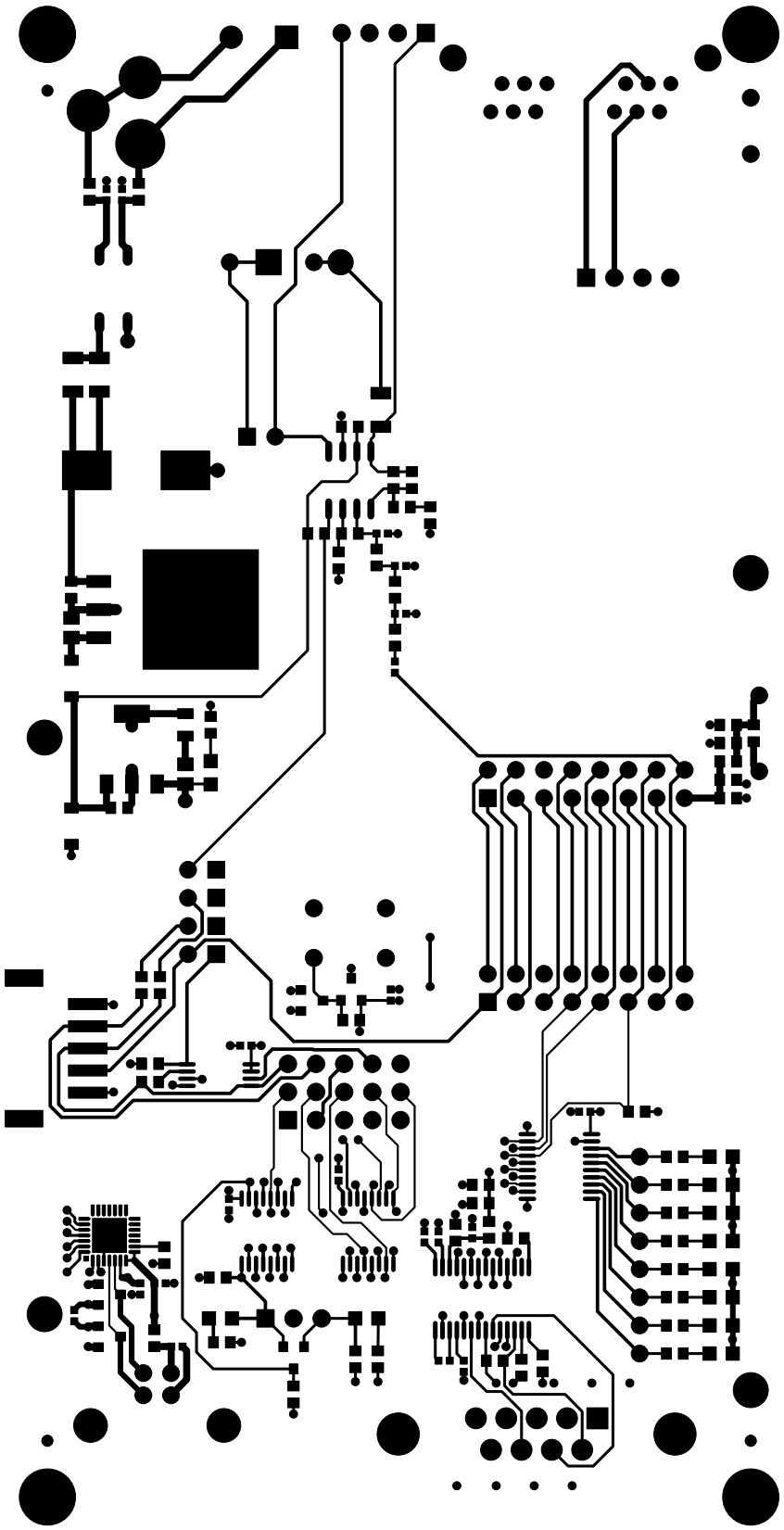


Figure 20. Motherboard Primary Side Layout

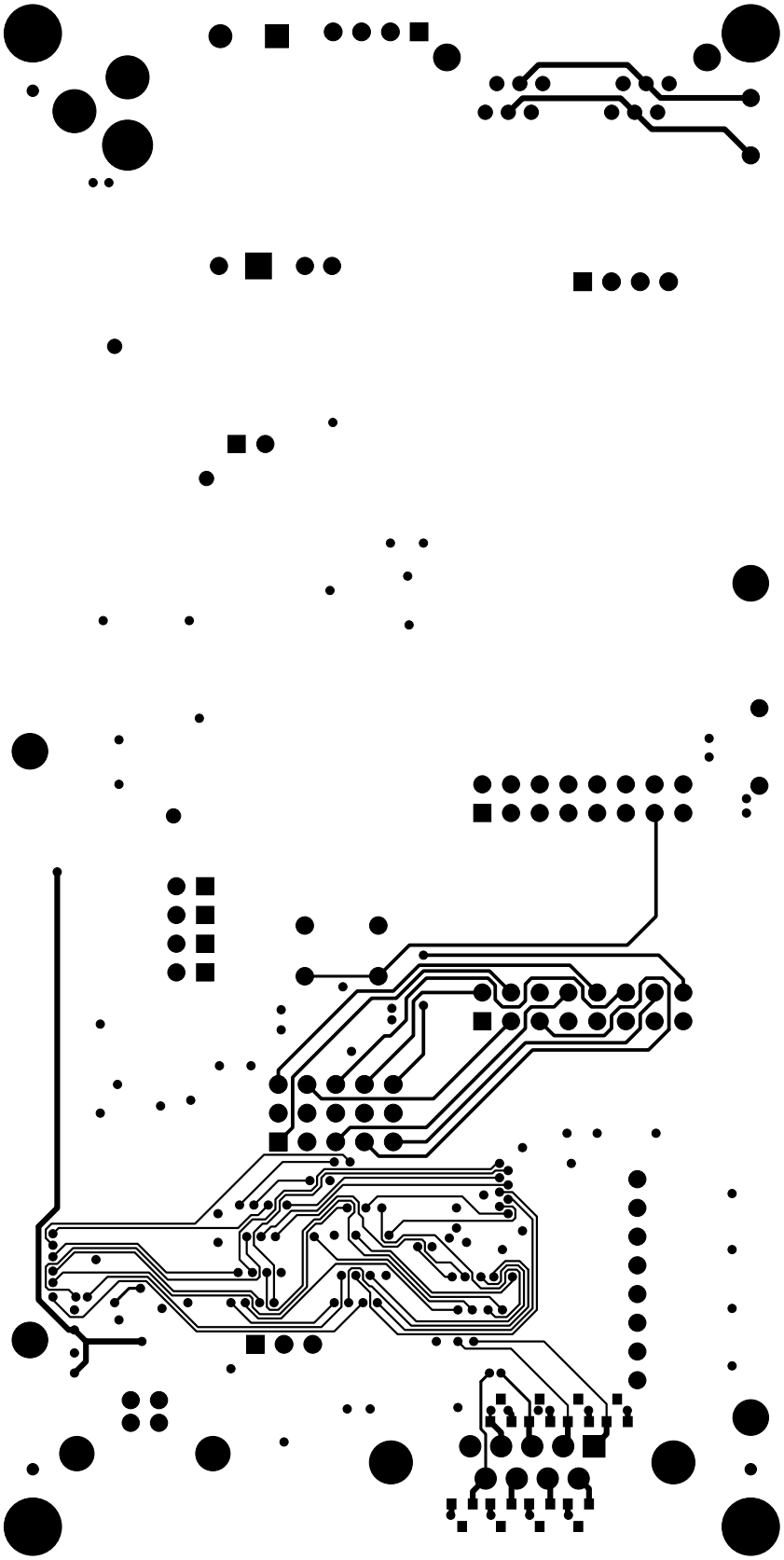


Figure 21. Motherboard Secondary Side Layout

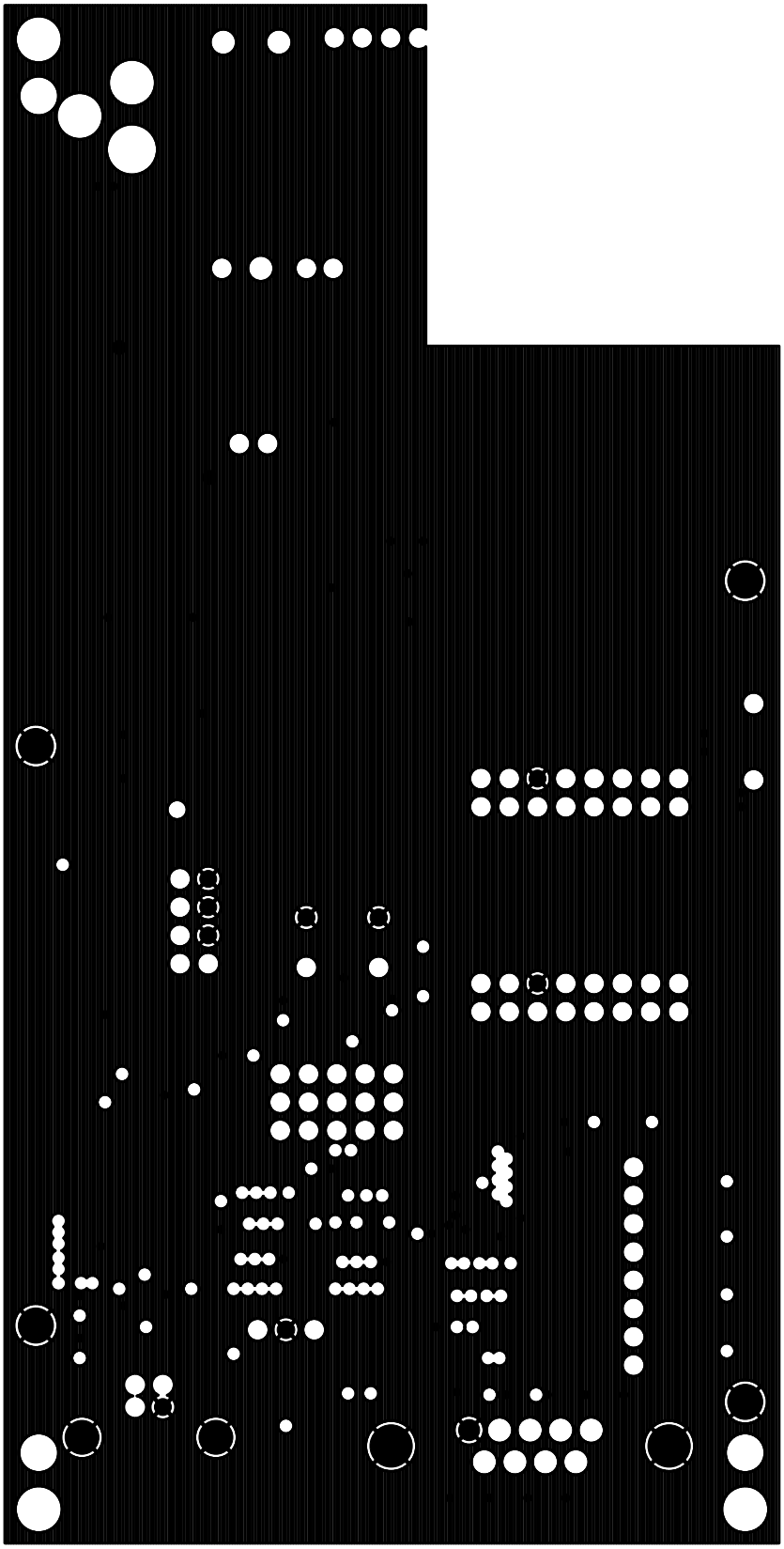


Figure 22. Motherboard Ground Plane Layout

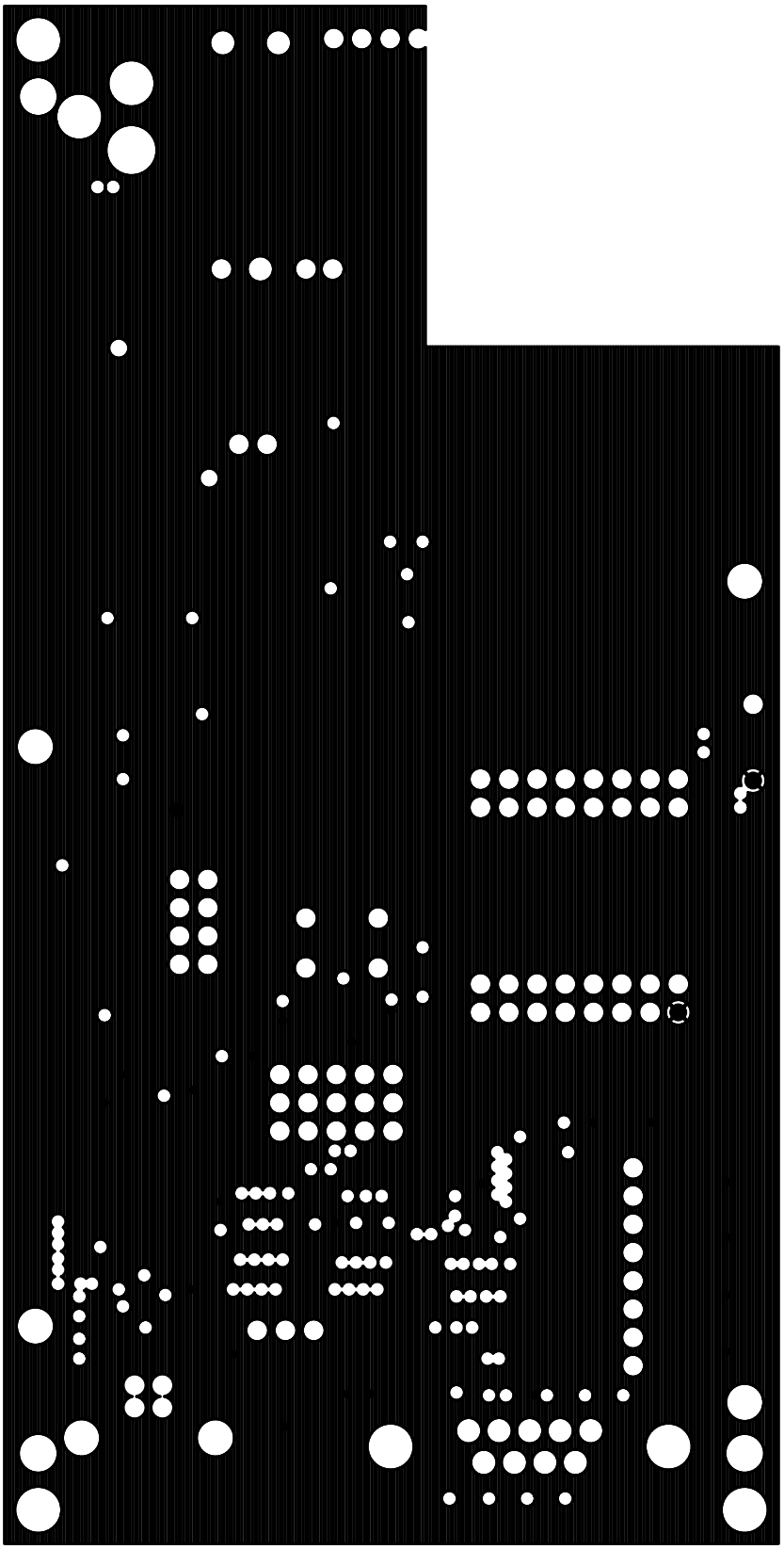


Figure 23. Motherboard Power Plane Layout

6. Complete Design Package on CD (See Sales Representative for Details)

Silicon Laboratories can provide a complete design package of the Si2493/57/34/15/04-EVB including the following:

- OrCad Schematics
- Gerber Files
- BOM
- Documentation

Contact your local sales representative or Silicon Laboratories headquarters sales for ordering information.

DOCUMENT CHANGE LIST

Revision 0.2 to Revision 0.3

- Updated Figure 15, “Daughter Card Secondary Side Silkscreen,” on page 24.
- Updated Figure 16, “Daughter Card Primary Side Layout,” on page 25.
- Updated Figure 17, “Daughter Card Secondary Side Layout,” on page 26.
- Updated “Bill of Materials: Si24xx Daughter Card” .

Revision 0.3 to Revision 0.4

- Changed from Rev.1.0 to Rev.1.1 Daughter Card.

Revision 0.4 to Revision 0.5

- Changed from Rev.3.1 to Rev.3.2 Motherboard.

Revision 0.5 to Revision 0.6

- Changed from Rev.1.1 to Rev.1.2 Daughter Card.
- Added FS (SOIC) Package Option.

Revision 0.6 to Revision 0.7

- Changed R1.2 to 2.0 daughtercard.
- Changed R32 to 5.0 motherboard.
- Changed power amplifier chip and speakers.
- Removed connector to SSI BUS.
- Changed regulator and power on reset circuit.
- Changed various jumper locations.

NOTES:

CONTACT INFORMATION

Silicon Laboratories Inc.
400 West Cesar Chavez
Austin, TX 78701
Tel: 1+(512) 416-8500
Fax: 1+(512) 416-9669
Toll Free: 1+(877) 444-3032

Please visit the Silicon Labs Technical Support web page:
https://www.silabs.com/support/pages/contacttechnicalsupport.aspx
and register to submit a technical support request.

The information in this document is believed to be accurate in all respects at the time of publication but is subject to change without notice. Silicon Laboratories assumes no responsibility for errors and omissions, and disclaims responsibility for any consequences resulting from the use of information included herein. Additionally, Silicon Laboratories assumes no responsibility for the functioning of undescribed features or parameters. Silicon Laboratories reserves the right to make changes without further notice. Silicon Laboratories makes no warranty, representation or guarantee regarding the suitability of its products for any particular purpose, nor does Silicon Laboratories assume any liability arising out of the application or use of any product or circuit, and specifically disclaims any and all liability, including without limitation consequential or incidental damages. Silicon Laboratories products are not designed, intended, or authorized for use in applications intended to support or sustain life, or for any other application in which the failure of the Silicon Laboratories product could create a situation where personal injury or death may occur. Should Buyer purchase or use Silicon Laboratories products for any such unintended or unauthorized application, Buyer shall indemnify and hold Silicon Laboratories harmless against all claims and damages.

Silicon Laboratories, Silicon Labs, and ISOmodem are trademarks of Silicon Laboratories Inc.

Other products or brandnames mentioned herein are trademarks or registered trademarks of their respective holders.

Mouser Electronics

Authorized Distributor

Click to View Pricing, Inventory, Delivery & Lifecycle Information:

Silicon Laboratories:

Si2439-A-FM18-EVB Si2493FS18-EVB Si2493FT18-EVB Si2457FS18-EVB Si2493FT08-EVB Si2493FS08-EVB Si2457FS08-EVB Si2457FT08-EVB Si2457-D-FT18-EVB Si2457-D-FS18-EVB